Chapter 4. Lakes and Reservoirs

4.1 Introduction

Since the initiation of the rotating basin approach in 1998, the state's significant publicly-owned reservoirs are monitored over a five-year cycle instead of the previous seven- to eight-year cycle. During this two-year reporting period, 31 reservoirs in the Green, Tradewater and Ohio River (minor tributaries) basins and eight reservoirs in the Tygarts Creek, Big Sandy, and Little Sandy river basins were monitored for trophic state and use support (Figures 4-1 – 16 in the back of this chapter).

Designated uses in lakes consist of Warm Water Aquatic Habitat (WAH) (sometimes in conjunction with Cold Water Aquatic Habitat (CAH) in lakes with a two-story fishery) and Primary and Secondary Contact Recreation (PCR and SCR). Many of the reservoirs also have a domestic water supply (DWS) use.

4.2 Methods

Sampling was conducted three times during the growing season, typically in late April to early May, July, and late September to early October. Composite nutrient and chlorophyll *a* samples were collected from the photic zone (one percent of light penetration), and dissolved oxygen, temperature, pH and specific conductivity measurements were obtained from profiles of the water column in the deepest part of the lake. Samples were taken in the area immediately upstream of the dam and at other locations on the main lake and major tributary embayments, depending on the size and configuration of each reservoir. Also, trophic data were provided by the U.S. Army Corps of Engineers (2001-2002) on lakes in the Green/Tradewater BMU.

Table 4-1. Criteria for lake use support classification.

Category	Warm Water Aquatic Habitat (At least two of the following criteria)	Secondary Contact Water Recreation (At least one of the following criteria)	Domestic Water Supply (At least one of the following criteria)
Not Supporting:	Fish kills caused by poor water quality	Widespread excess macrophyte/macro-scopic algal growth	Chronic taste and odor complaints caused by algae
	Severe hypolimnetic oxygen depletion	Chronic nuisance algal blooms	Chronic treatment problems caused by poor water quality
	Dissolved oxygen average less than 4 mg/l in the epilimnion		Exceeds drinking water MCL
Partially Supporting: (At least one of the following criteria)	Dissolved oxygen average less than 5 mg/l in the epilimnion	Localized or seasonally excessive macrophyte/macroscopic algal growth	Occasional taste and odor complaints caused by algae
	Severe hypolimnetic oxygen depletion	Occasional nuisance algal blooms	Occasional treatment problems caused by poor water quality
	Other specific cause (i.e. low pH)	High suspended sediment concentrations during the recreation season	
Fully Supporting:	None of the above	None of the above	None of the above

4.3 Assessment of Trophic State and Use Support

Trophic status was assessed in lakes by using the Carlson Trophic State Index (TSI) for chlorophyll *a*. This method is convenient because it allows lakes to be ranked numerically according to increasing eutrophy, and it also provides for a distinction between oligotrophic, mesotrophic, eutrophic, and hyper-eutrophic lakes. The growing season (April – October) average TSI value was used to rank each lake. Areas of lakes that exhibited trophic gradients or embayment differences often were analyzed separately. Use support in lakes was determined by criteria listed in Table 4-1.

4.4 Results

4.4.1 Statewide

Tables 4-2, 4-3 and 4-4 present statewide summaries of use support, causes and sources of impairments of reservoirs and lakes in the state. The water quality assessment of lakes includes more than 90 percent of the publicly-owned lake acreage of Kentucky. Sixty-seven of 107 lakes (62.6 percent) fully support their uses, 33 (30.8 percent) partially support uses, and 7 (6.5 percent) do not support one or more uses. On an acreage basis, more than 55 percent (120,372 acres) of the 217,597 assessed acres fully support uses, 43 percent (93,311 acres) partially support uses, and less than two percent (3,914 acres) do not support one or more uses (Table 4-2).

Mercury in fish tissue is the most frequent cause of uses in lakes not being fully supported (Table 4-3). Nutrients and organic enrichment/low dissolved oxygen are the second most frequent causes of use impairment, with agricultural runoff, land disposal and septic tanks the principal sources of the nutrients (Table 4-4). A fish consumption advisory for PCBs is in place on one reservoir of considerable size (Green River Lake), resulting in a high percentage of lake acres impacted by priority organics (Table 4-3). Naturally shallow lake basins (habitat alterations and siltation when combined), which allow the proliferation of nuisance aquatic weeds that impair secondary contact recreation, account for the fifth highest cause of use nonsupport. Other

Table 4-2. Lake use support summary, acres.

Use	Assessed	Fully Supporting	Partially Supporting	Not Supporting
Overall Support	217,597 (107)	120,372 (67)	93,311 (33)	3,914 (7)
Aquatic Life Support	217,597	207,647	6,176	3,775
Fish Consumption	203,513	115,688	87,825	0
Primary Contact Recreation	4,389	4,170	219	0
Secondary Contact Recreation	6,919	2,940	3,979	0
Drinking Water Supply	201,810	200,099	1,572	139

Table 4-3. Causes of use impairment in lakes.

Name	Acres Affected	Percent
Priority Organics	8,210	7
Metals	87,825	76
Nutrients	7,676	7
pH	219	<1
Siltation	2,417	2
Organic enrichment/Low DO	6,035	5
Other habitat alterations	413	<1
Taste and odor	854	<1
Suspended solids	1,810	<2
Algal Growth/Chlorophyll *a*	379	<1

Table 4-4. Sources of impairment in lakes.

Name	Acres Affected	Percent
Industrial Point Sources	8,210	24
Municipal Point Sources	4,309	12
Agriculture	9,074	26
Resource Extraction	3,259	9
Land Disposal	4,196	12
Contaminated Sediments	18	<1
Internal Nutrient Cycling (primarily lakes)	3,366	10
Natural Sources	2,401	7

natural conditions such as manganese releases from anoxic hypolimnetic water and nutrients in runoff from relatively undisturbed watersheds affect domestic water supply and secondary contact uses, respectively. Suspended solids from surface mining activities, which have decreased in severity as a source from previous years, impaired the secondary contact recreation use in only one eastern Kentucky reservoir.

4.4.2 Green/Tradewater and Sandy/Tygarts Basin Management Units

In the Green/Tradewater BMU, 22 reservoirs are eutrophic, seven mesotrophic and two oligotrophic. (Tables 4-5 and 4-6). Twenty of these reservoirs fully support uses and 11 partially support uses (Figures 4-1 – 16 at the end of this chapter).

Of the eight lakes and reservoirs monitored in the Big Sandy/Little Sandy/Tygarts BMU, five fully supported uses and three partially supported uses (Tables 4-5 and 4-6). The most common causes were mercury in fish tissue and nutrients (phosphorus, nitrogen) that eventually result in depleted or lowered dissolved oxygen in the water column.

Table 4-5. Lakes/reservoirs in Green/Tradewater and Big Sandy/Little Sandy/Tygarts BMUs fully supporting all uses.

Lake	Acres	County	Trophic State	Uses
Green River Basin				
Briggs Lake	19	Logan	Eutrophic	WAH,PCR,SCR
Carpenter Lake	64	Daviess	Eutrophic	WAH,PCR,SCR
Freeman Lake	160	Hardin	Mesotrophic	WAH,PCR,SCR,DWS
Kingfisher Lake	30	Daviess	Eutrophic	WAH,PCR,SCR
Lake Malone	826	Logan	Eutrophic	WAH,PCR,SCR,DWS
Lake Washburn	26	Ohio	Mesotrophic	WAH,PCR,SCR
Lewisburg Lake	51	Logan	Mesotrophic	WAH,PCR,SCR
Liberty Lake	79	Casey	Oligotrophic	WAH,PCR,SCR,DWS
Metcalfe County Lake	22	Metcalfe	Eutrophic	WAH,PCR,SCR
Mill Creek Lake (Monroe Co.)	109	Monroe	Eutrophic	WAH,PCR,SCR,DWS
Nolin River Reservoir	5790	Hart	Eutrophic	WAH,PCR,SCR,DWS
Pennyrile Lake	47	Christian	Mesotrophic	WAH,PCR,SCR
Shanty Hollow Lake	135	Warren	Eutrophic	WAH,PCR,SCR
Spurlington Lake	36	Taylor	Eutrophic	WAH,PCR,SCR
Ohio River (Minor Tribs) River Basin				
Lake George	53	Crittenden	Eutrophic	WAH,PCR,SCR,DWS
Mauzy Lake	84	Union	Eutrophic	WAH,PCR,SCR
Tradewater River Basin				
Lake Beshear	760	Caldwell	Eutrophic	WAH,PCR,SCR,DWS
Loch Mary	135	Hopkins	Mesotrophic	WAH,PCR,SCR,DWS
Moffit Lake	49	Union	Eutrophic	WAH,PCR,SCR
Providence City Reservoir	35	Webster	Oligotrophic	WAH,PCR,SCR,DWS
Big Sandy River				
Fishtrap Reservoir	1143	Pike	Mesotrophic	WAH,PCR,SCR
Martin County Lake	23	Martin	Oligotrophic	
Yatesville Reservoir	2242	Lawrence	Mesotrophic	WAH,PCR,SCR
Little Sandy River				
Greenbo Lake	181	Greenup	Oligotrophic	WAH,PCR,SCR,DWS
Tygarts Creek				
Smoky Valley Lake	36	Carter	Mesotrophic	WAH,PCR,SCR

Table 4-6. Lakes/reservoirs in Green/Tradewater and Big Sandy/Little Sandy/Tygarts BMUs partially supporting one or more uses.

Lake	Acres	County	Trophic State	Uses Impaired	Causes	Sources
Green River Basin						
Barren River Res.	10000	Allen	Eutrophic	FC	Mercury	Source Unknown
Campbellsville City Res.	63	Taylor	Eutrophic	SCR	Siltation	Agriculture, Natural Sources
Caneyville City Res.	75	Grayson	Eutrophic	SCR,DWS	Nutrients, Siltation	Natural Sources
Grapevine Lake	50	Hopkins	Mesotrophic	DWS	Nutrients	Source Unknown
Green River Res.	8210	Taylor	Eutrophic	FC	Mercury,PCBs	Source Unknown, Industrial Point Sources
Lake Luzerne	55	Muhlen-berg	Mesotrophic	DWS	Nutrients	Source Unknown
Lake Peewee	360	Hopkins	Eutrophic	DWS	Nutrients	Agriculture
Rough River Res.	5100	Hardin	Eutrophic	FC	Mercury	Source Unknown
Salem Lake	99	Larue	Eutrophic	SCR	Other Habitat Alterations	Agriculture
Spa Lake	240	Logan	Eutrophic	SCR	Siltation,Algal Growth/Chloro-phyll-a,Other habitat alterations	Agriculture, Natural Sources
Ohio River Basin						
Scenic Lake	18	Henderson	Eutrophic	WAH	Nutrients	Internal nutrient recycling, contaminated sediments
Big Sandy River						
Dewey Lake	1100	Floyd	Mesotrophic	SCR	Suspended Solids	Resource Extraction (Surface Mining)
Paintsville Res.	1139	Johnson	Oligotrophic	FC	Mercury	Source Unknown
Little Sandy River						
Grayson Lake	1512	Carter	Mesotrophic	FC	Mercury	Source Unknown

[a] WAH = Warm Water Aquatic Life; FC = Fish Consumption; DWS = Domestic Water Supply

Figure 4-1. Reservoirs monitored in the Green-Tradewater Basin.

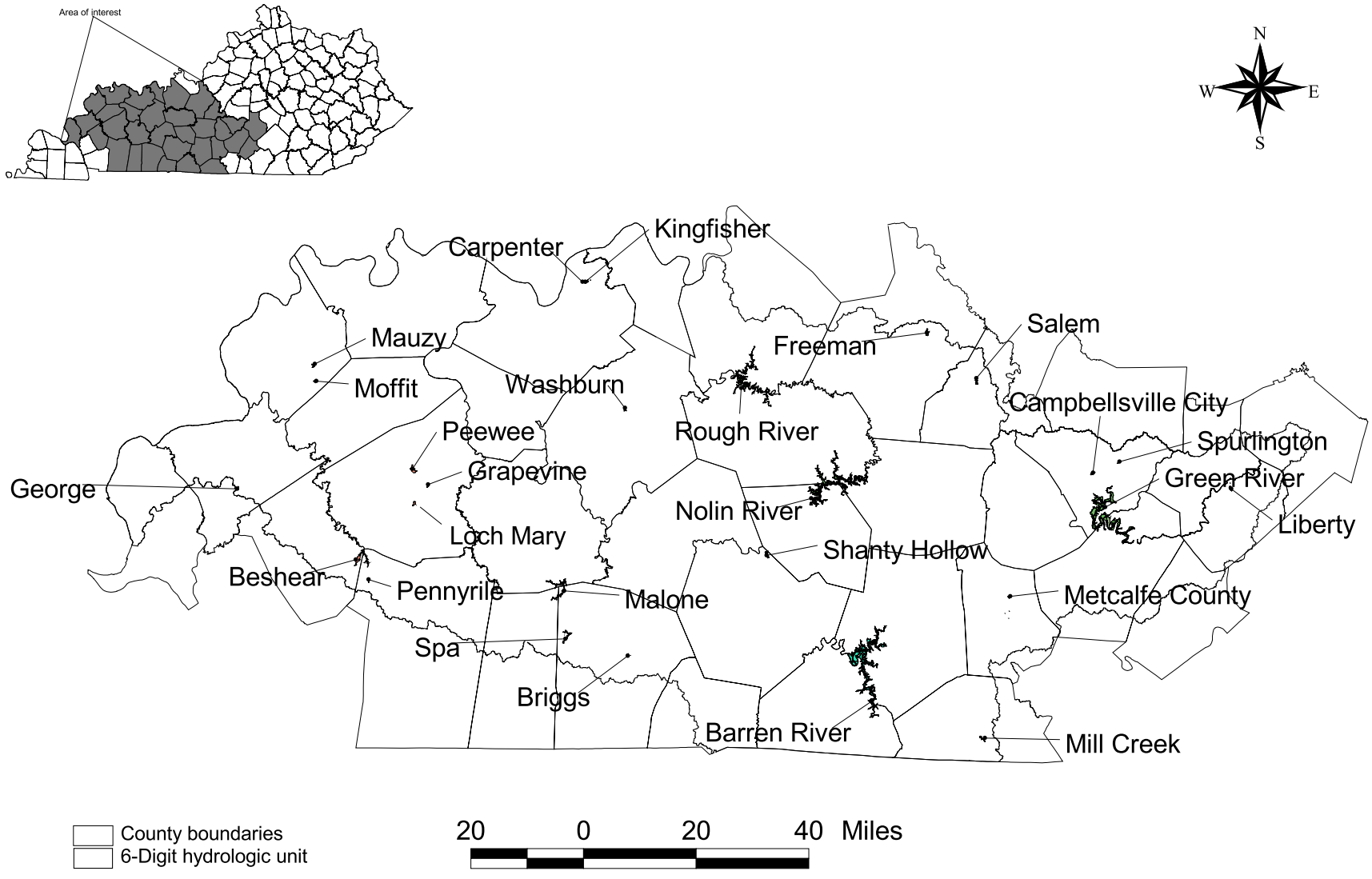
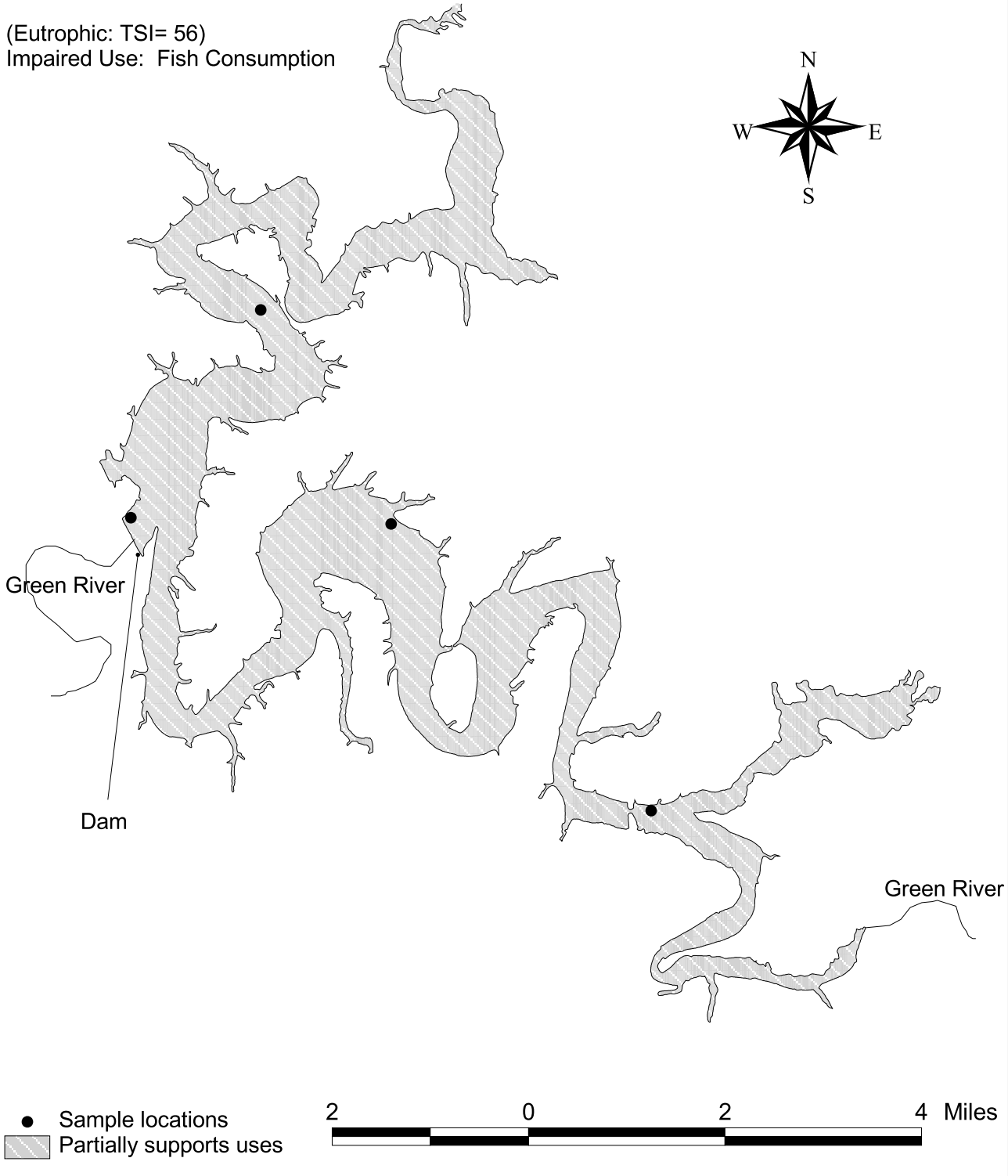


Figure 4-2. Monitoring sites on Green River Reservoir in the Green/Tradewater Basin Management Unit.

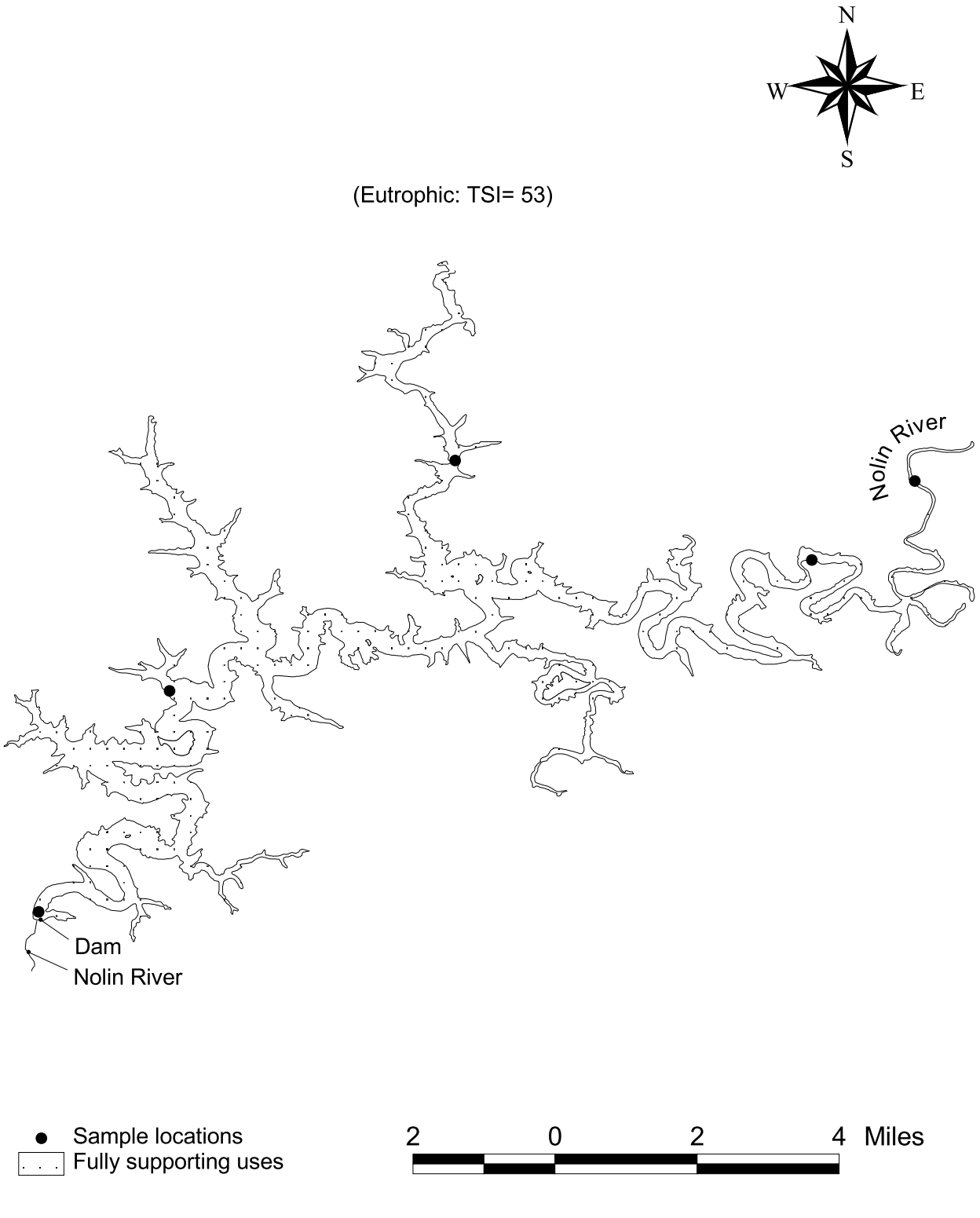


Source 2004 305(b) Report

Figure 4-3. Monitoring sites on Barren River Reservoir in the Green/Tradewater Basin Management Unit.

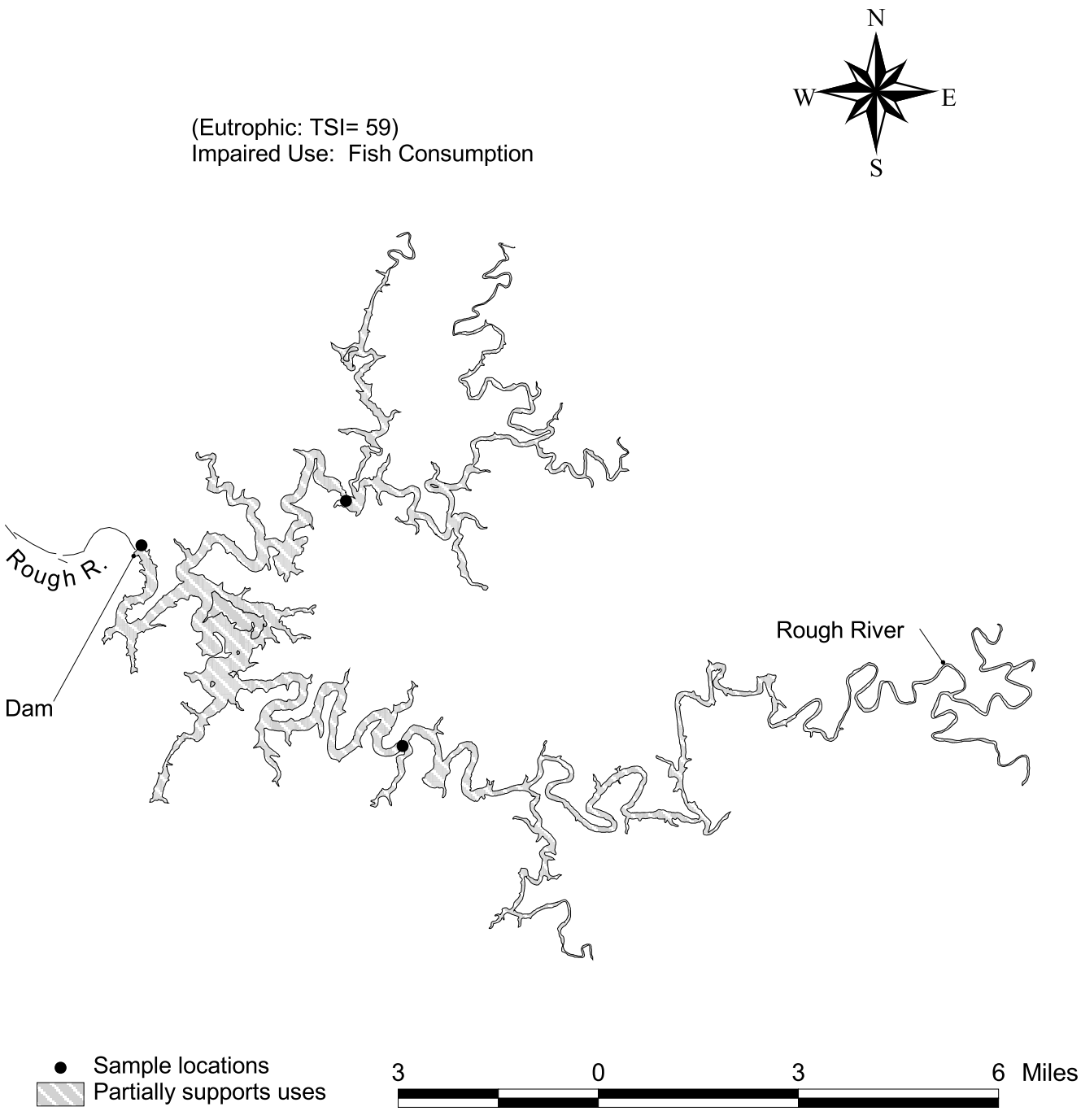
Source 2004 305(b) Report

Figure 4-4. Monitoring sites on Nolin River Reservoir in the Geen/Tradewater Basin Management Unit.



Source 2004 305(b) Report

Figure 4-5. Monitoring sites on Rough River Reservoir in the Green/Tradewater Basin Management Unit.



Source 2004 305(b) Report